Basic Scalar Techniques

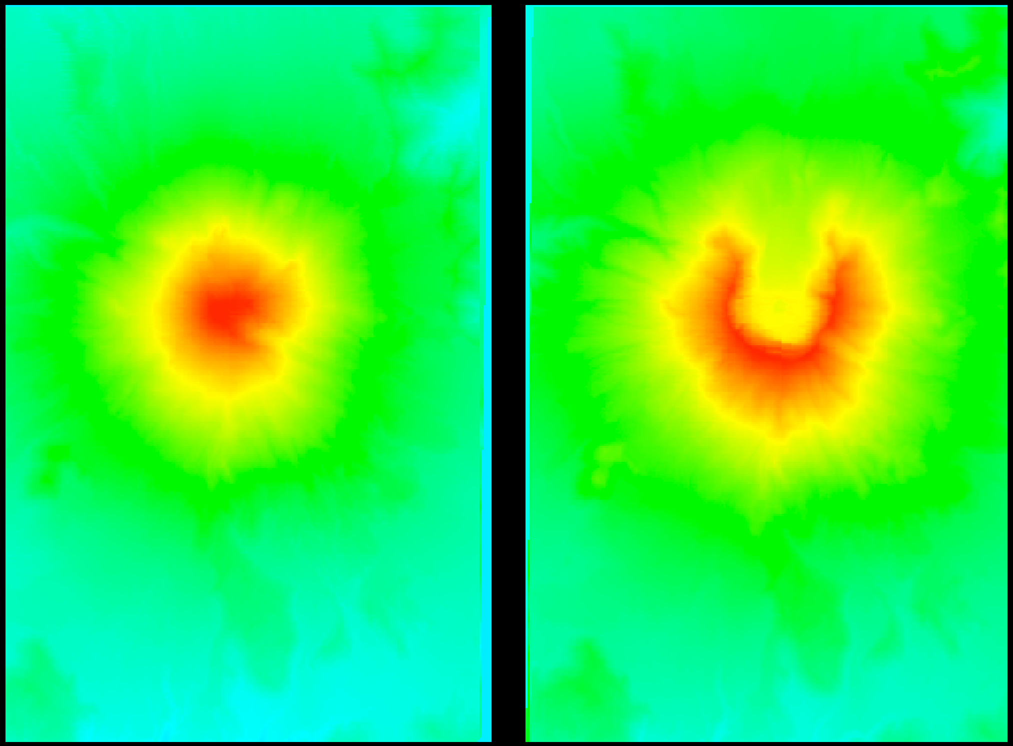
Lecture 6

1D and 2D Scalar Data

- Graphs
  - Line / Bar / Pie etc
  - Scatter
- “Images”
  - Data Arrays as Images
  - RGB(A) Images

Data as Images

- Colour used to indicate height
- Mount St Helens Before and After

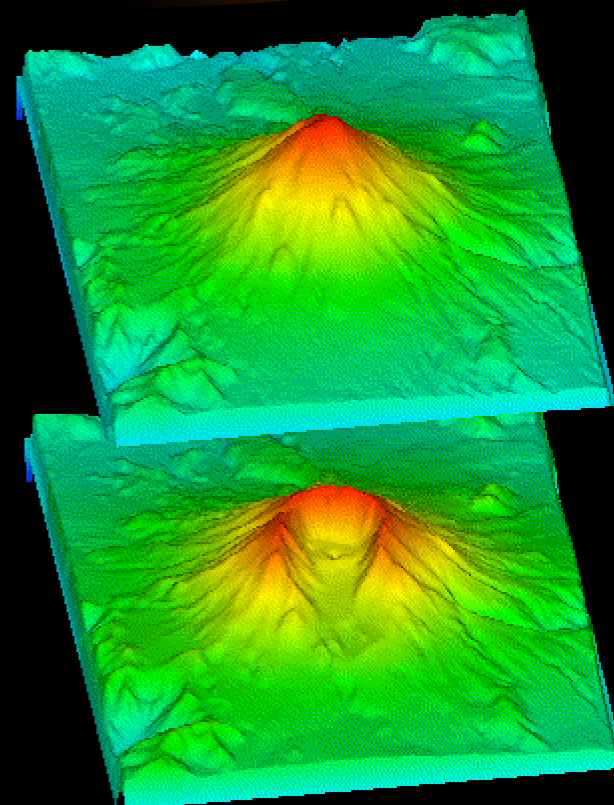


"2.5D" Data (2D 3Space)

- Surface Height Plots
- Turn 2D array of data into 3D mesh by using Node Data to compute an extra physical dimension.
- Following example we take the Mount St Helens height data and use it to create a surface, $z = f(x,y)$

Surface Height

- Use visual impact of surface height to compare datasets
- Mount St. Helens Before and After



3D Data Sets

3D Data Sets

- One simple technique to show all the data in a volume is by displaying a point or small object at each data location.
- The object needs to be small enough and the array sparse enough to avoid confusion.
- Explore other 3D *Volume* visualisation techniques more fully later.

Scatter Data (1D 3Space)

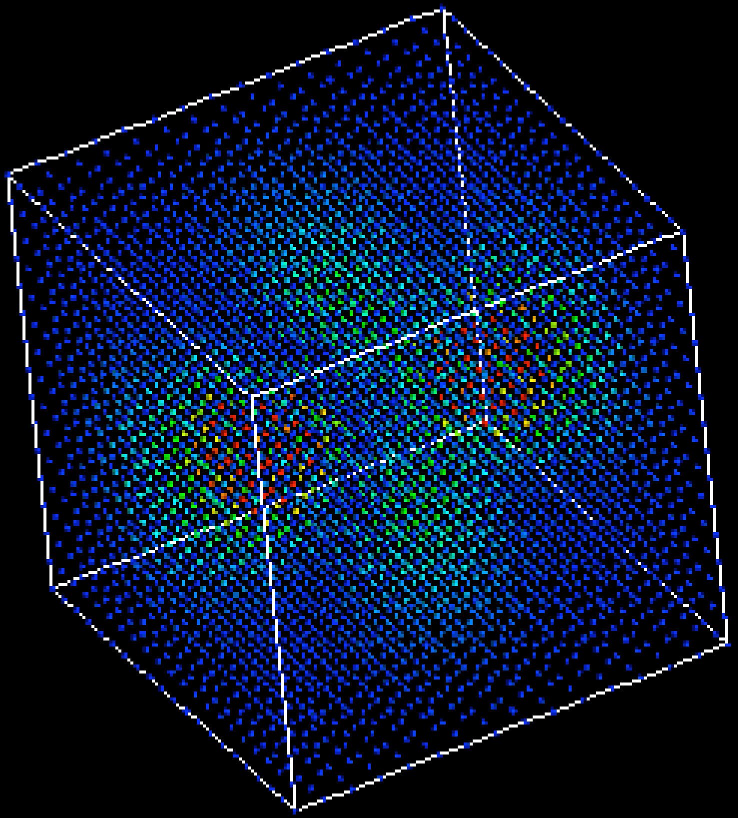
- Simple
- No connectivity
- Colour/glyphs at each point for data values
- Examples of Data:
  - True X,Y,Z (,Value) data
  - 1-3D computational array, map each dimension to a physical axis.

Scatter Data Example

- Cube of data. Each dot represents one data element (possibly thinned).
- Colour relates to data value.
- Dot size could be related to same or different value.

Scattered Data Example...

- General structure in volume can be seen.
- May be improved by hiding blue values.

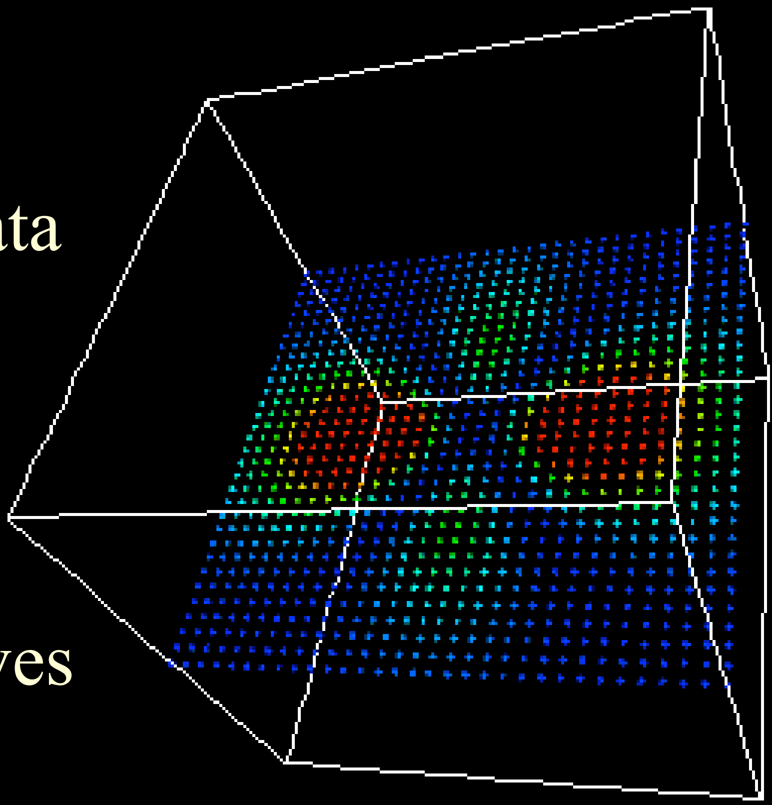


3D Data

- For now we look at techniques to convert 3D data into 2D surfaces by reducing dimensionality
  - Contouring
  - Slicing Planes (Orthogonal/Arbitrary)
  - Isosurfaces

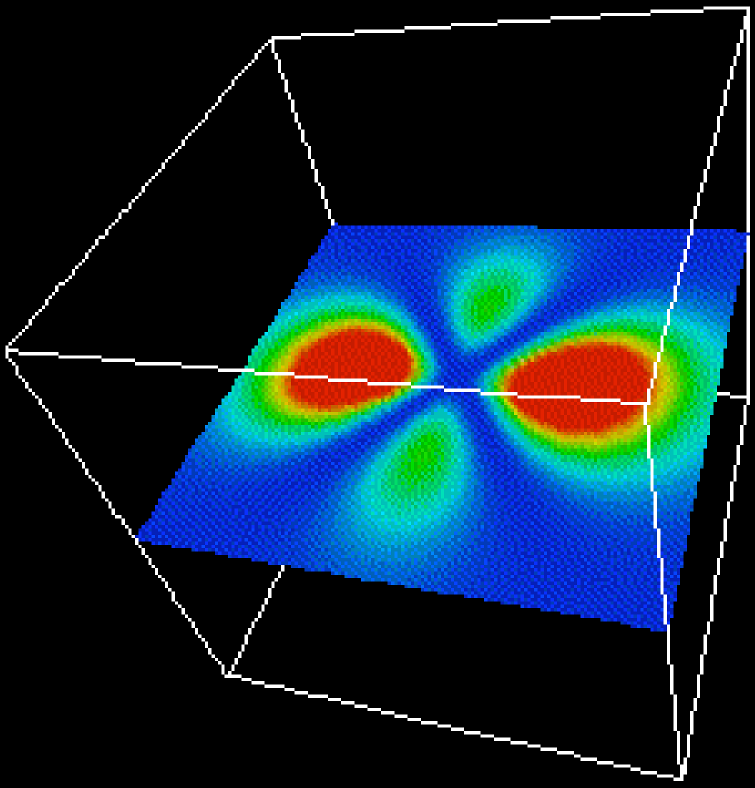
Slice 3D Datasets

- Take a 2D slice from a 3D dataset
- Display as scattered data
- Detail is clearer
- Note bounding box gives context



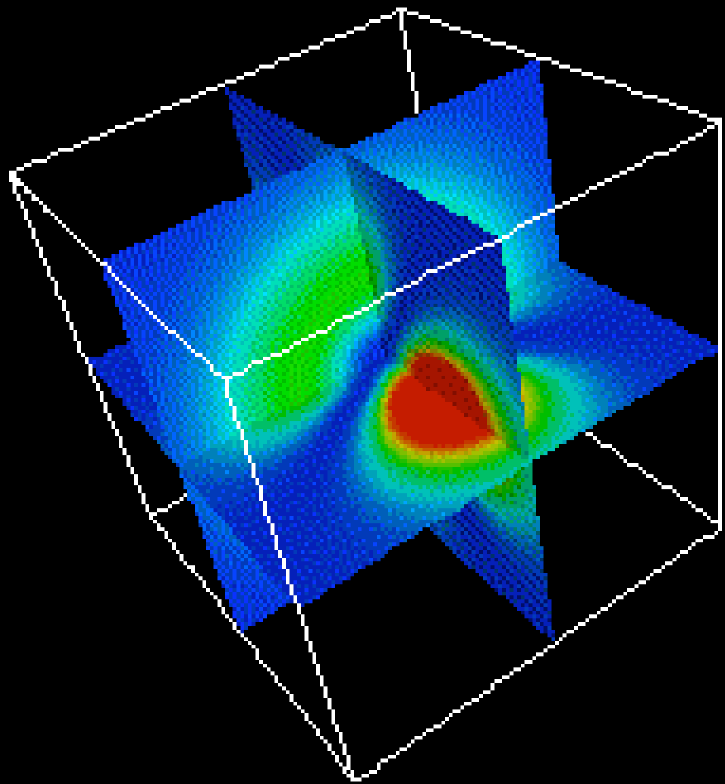
Orthoslices

- Turn slice data into a flat surface (mesh)
- Apply smooth colour interpolation
- Detail very clear



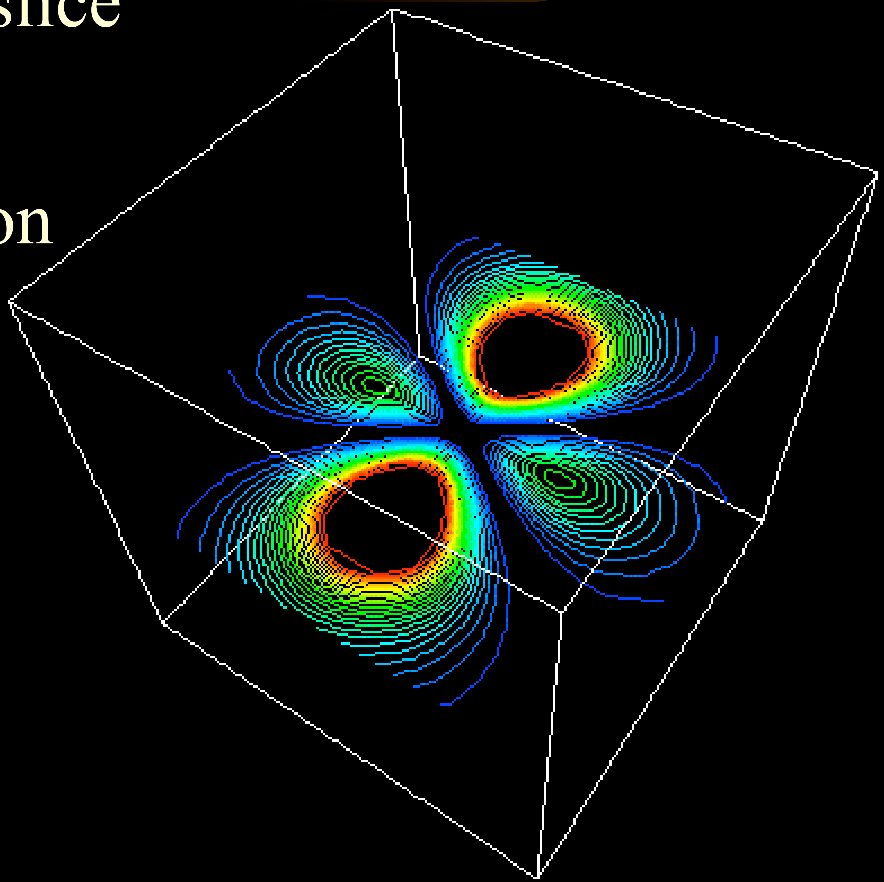
Orthoslice Overdose

- Multiple orthoslices can be used to good effect



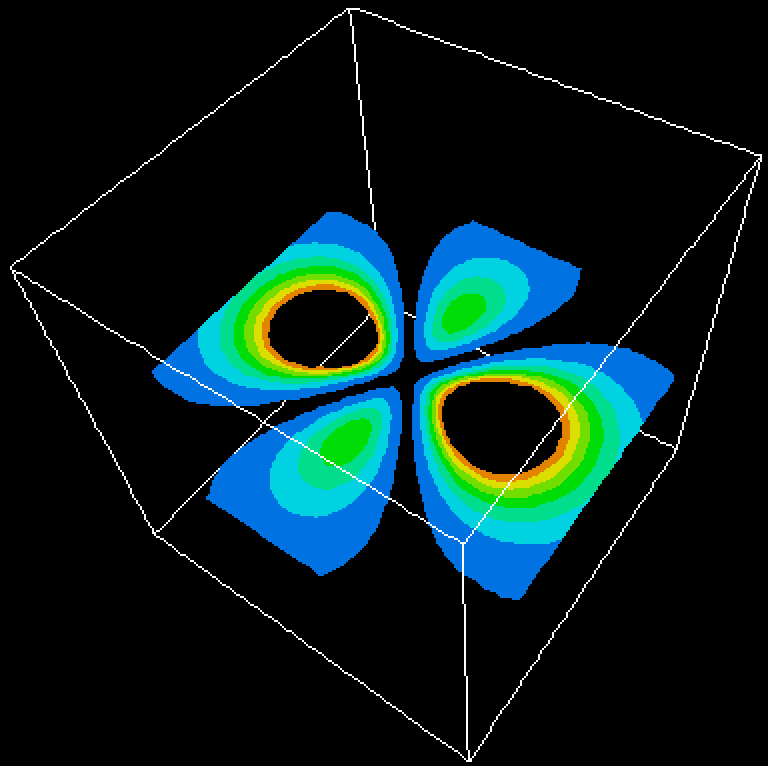
Contours

- Contours / Isolines of slice
- Alternative visualisation technique
- Contours are between specified min and max levels



2D Solid Contours

- Coloured solid contour bands

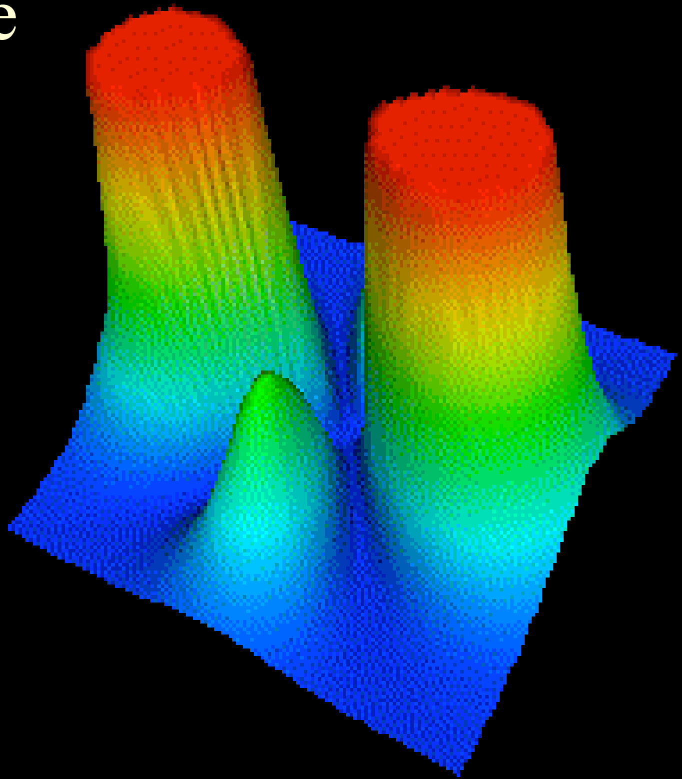


Surface Height Plots

- Same technique as before

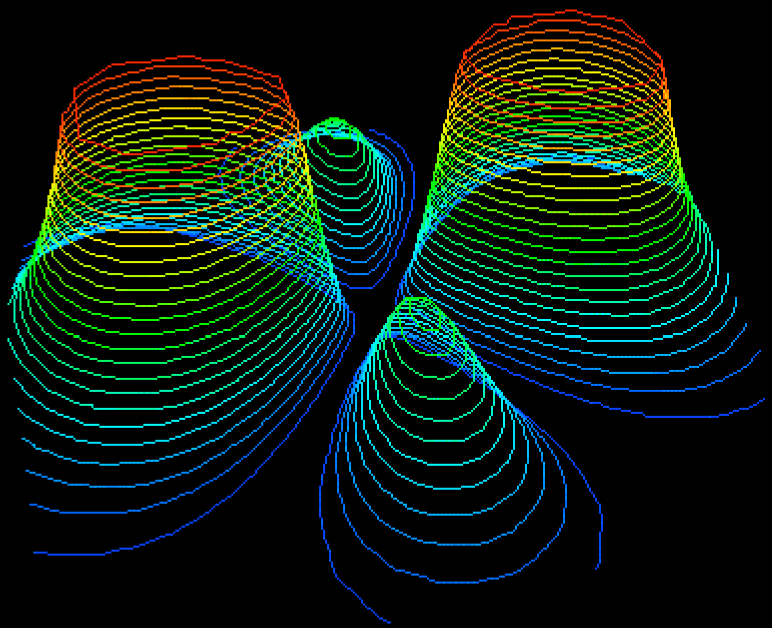
  node data -> extra dimension

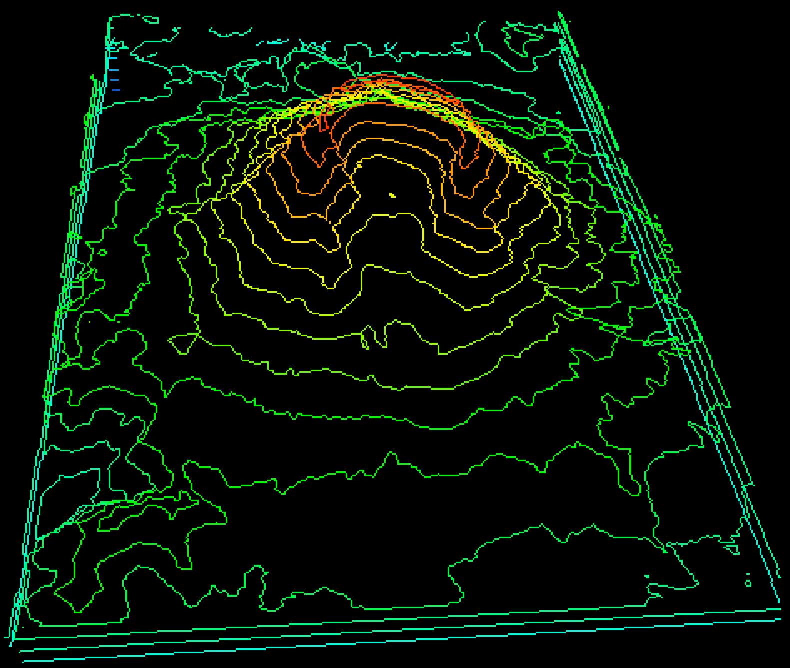
- Extra dimension has no meaning other than to improve interpretation.



Combining Techniques

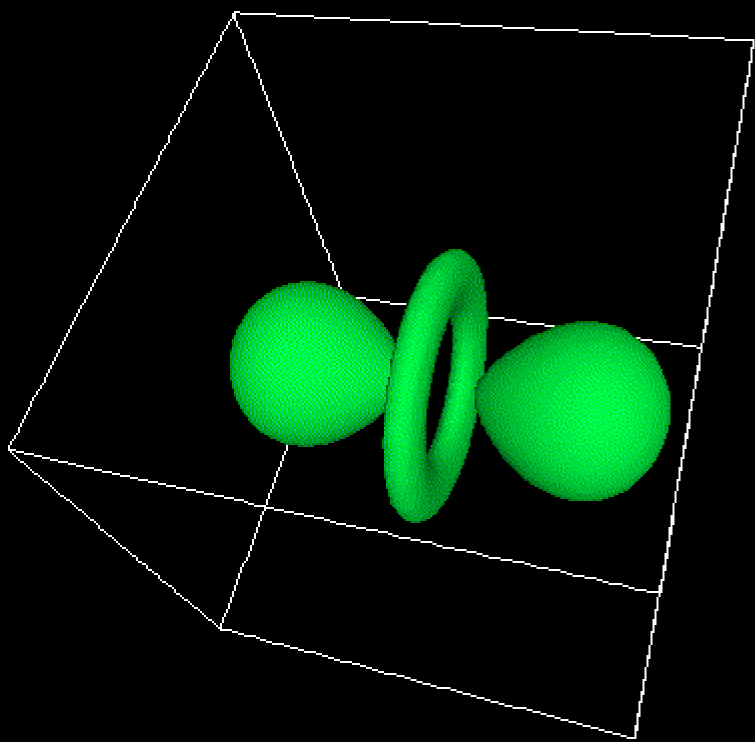
- 3D Contours

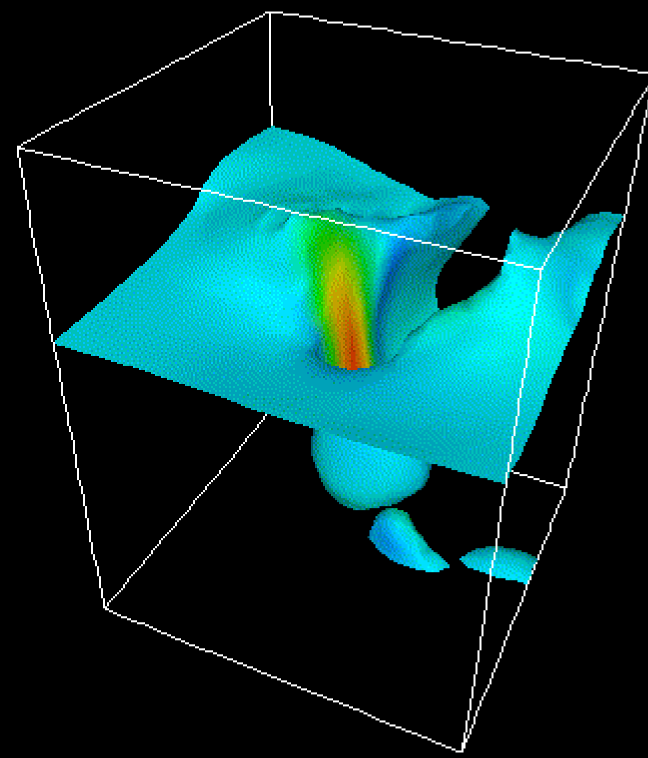




IsoSurface

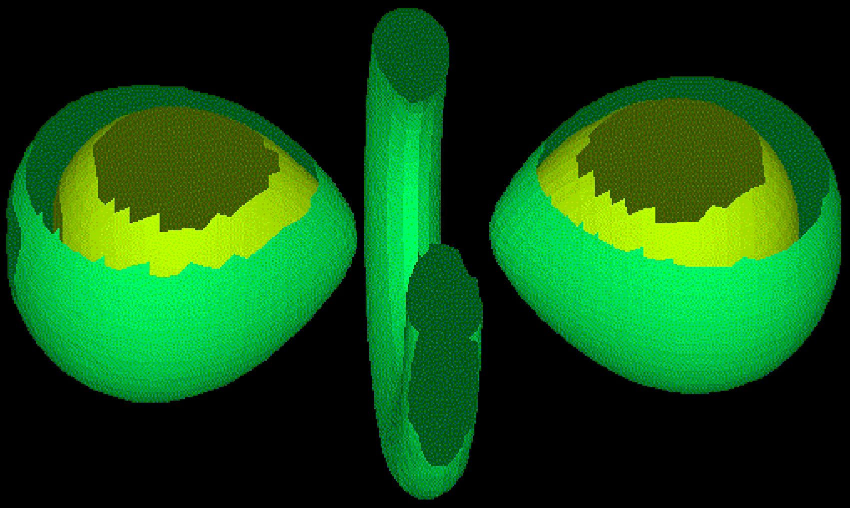
- Surface generated by connecting regions with same specified scalar value
- Optionally colour by another variable





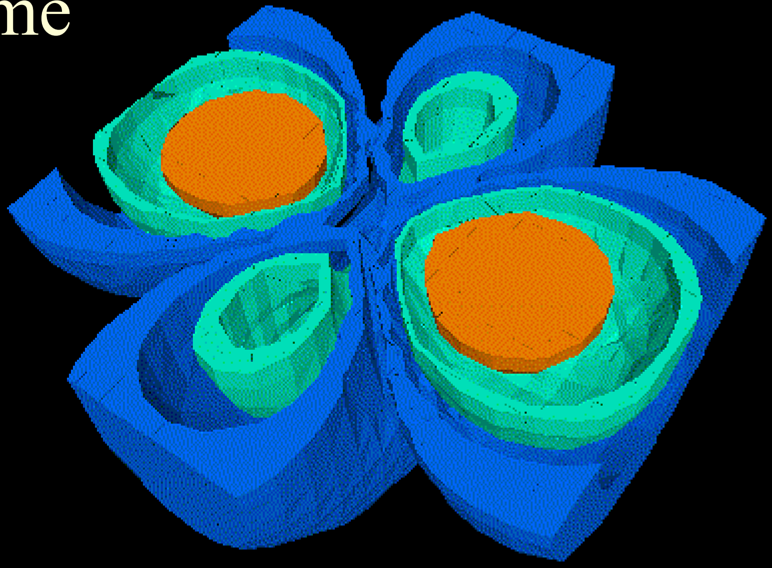
Multiple IsoSurfaces

- Isosurfaces are mathematically thin surfaces.
- Multiple isosurfaces can she shown if volume is cut open.



3D Solid Contours

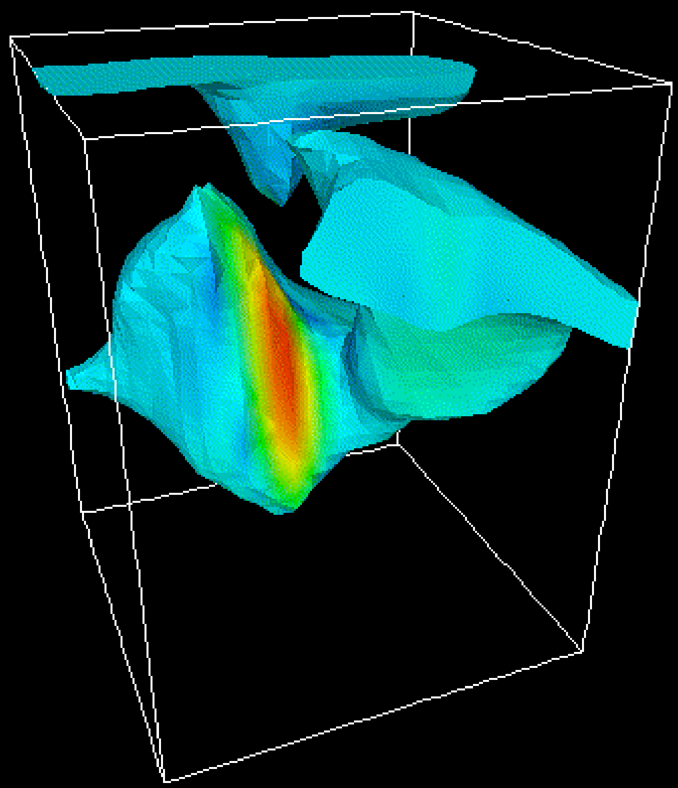
- Solid contours create volumes containing the same value (within +/- delta)
- Here 3 separate solid contours are shown by cutting away volume



IsoVolumes

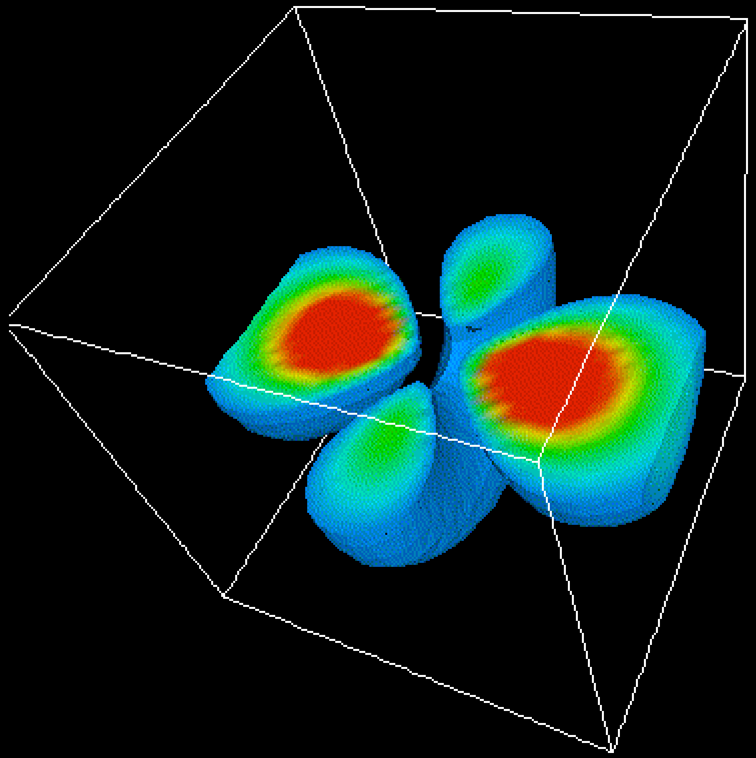
- Creates a volume of all cells with data values above/below a threshold

- Here external surface is coloured by a different variable



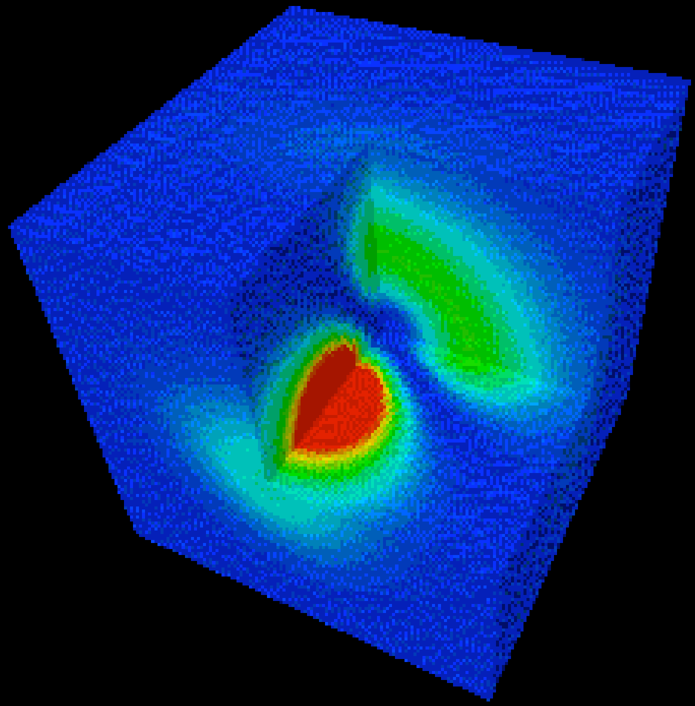
Cutaway IsoVolume

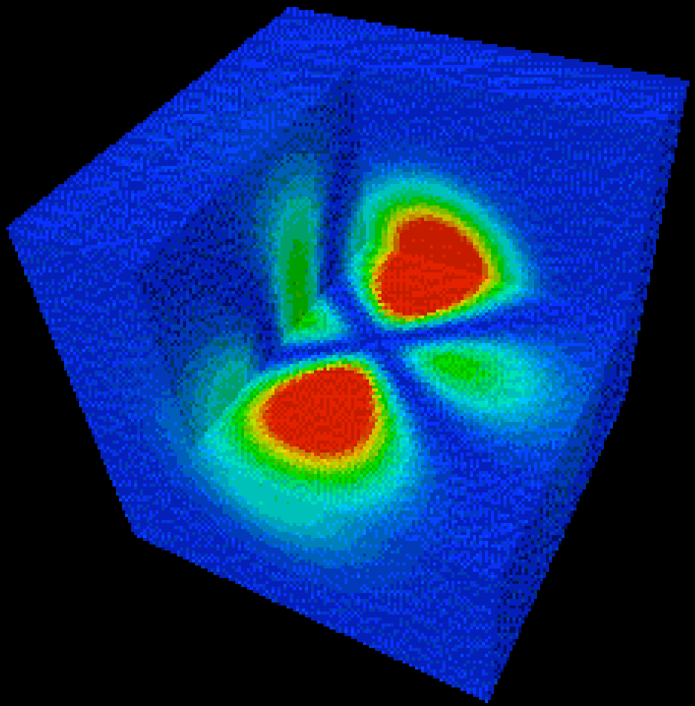
- Cutting away an isovolume shows internal structure.



Volume Cutaways

- Similar to orthogonal slicer.
- Bounding surfaces displayed + internal region.





Texture Mapping

Generally used to lay satellite imagery over Digital Elevation Model (DEM) data.

End

Lecture 6